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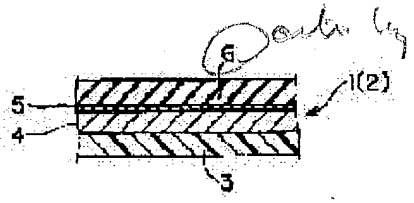
(54) THIN BATTERY BAG BODY

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a bag body having a superior perforation resistance against the impact such as falling, collision, etc., and pressure, etc., by a pointed material by forming an elastic thin film with its stuck thereto by the bag body in the whole face at least one of the front and rear of the bag body.

SOLUTION: A film base material constituted of a prescribed-thickness inside resin layer 3 composed of denaturated polypropylene, a prescribed-thickness intermediate metal layer 4 composed of aluminum foil, and a prescribed- thickness outer rubber layer (elastic thin layer) 6 composed of hydrogenation NBR bonded and fixed to the whole surface of the intermediate metal layer 4 via an urethane-based adhesive material layer 5 is used for a laminate material 2 constituting this thin-type battery bag body 1 so as to be formed into a rectangular bag body by a four-side sealing method. The four sides are sealed by heating with a power-generating element arranged between two laminate materials 2 and the electrode of the power generating element is projected from one side of the heat seal part. The outer rubber layer 6 is provided on the whole face of the surface of the bag body 1 so that the impact absorbing property can be drastically increased while holding the flexibility of the bag body 1.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the bag body for thin cells which contains the generation-of-electrical-energy element for thin cells, such as a lithium polymer rechargeable battery.
[0002]
[Description of the Prior Art] With development of the latest various electronic equipment, the needs of the miniaturization of electronic equipment and space-saving-izing are increasing, and the thin cell (sheet-like cell) used for this is also asked for the further thin-shape-izing and flexibility. The lithium polymer rechargeable battery using the gel electrolyte which aimed at current and thin shape-ization is going into the phase of utilization, and the lithium polymer rechargeable battery which polymer-ized all also including a positive-electrode negative-electrode material also has it in a development phase further.
[0003] Drawing 10 and drawing 11 show the example of structure of a lithium polymer rechargeable battery (the positive-electrode negative-electrode material is not polymer-ized). In drawing, for a positive-electrode charge collector (aluminium foil) and 22, as for an isolator (polymer electrolyte plasticized with the solvent), and 24, a positive electrode (lithium content multiple oxides, such as a cobalt acid lithium) and 23 are [21 / a negative electrode (carbon material) and 25] negative-electrode charge collectors (copper foil), and these generations-of-electrical-energy element is contained by the receipt means 26 (in this example of structure, the laminate material thin as a receipt means 26 is used). Moreover, the heat-sealing section by which 26a was formed in the periphery section of the receipt means 26, and 27 are electrodes.
[0004] In being able to give flexibility to a generation-of-electrical-energy element, since such a lithium polymer rechargeable battery has the low danger of a liquid spill, it can contain a generation-of-electrical-energy element with a thin laminate material like the above-mentioned example of structure. For example, in JP,9-7636,A, the three-layer lamination foil of a polyethylene layer, an aluminum foil layer, and a polyethylene layer is used as a laminate material. And such a lamination type thin cell is in remaining as it is or the condition contained by the hard case, and is built into the interior of electronic equipment. Moreover, in a flat mold cell, thereby, also when a pressure is added, the internal cell generation-of-electrical-energy element is made to cover a macromolecule thin film to the outside surface except the periphery section, to be what sharpened [ball-point] from the exterior, and not to carry out breakage etc. in JP,61-256559,A.
[0005]
[Problem(s) to be Solved by the Invention] However, in order to respond to the needs of the further miniaturization of electronic equipment, and space-saving-izing, when a lamination type thin cell must be inserted in a narrower dead space and there is no elastic body in the periphery section, in case it is the above-mentioned insertion, there are the idiosoma and a possibility of inviting **** of a laminate material -- a pars basilaris ossis occipitalis making a hole in a laminate material in the projected part inside electronic equipment especially -- of a thin cell. Moreover, by the collision with the projected part inside the above-mentioned electronic equipment, drop of the thin cell under a manufacturing process and transport, the collision to other objects, the drop impact of the whole device electronic equipment in use, etc., the generation-of-electrical-energy element inside a laminate material hits a laminate material strongly, and a possibility of inviting **** of a laminate material has also made the hole in a laminate material on the square. Then, if the metallic foil which constitutes a laminate material is thickened or is protected with a strong box, small-and-light-izing or the flexible effect of what can improve the hole-proof vacancy nature of a laminate material will not be acquired.
[0006] This invention was made in view of such a situation, and it sets offer of the bag body for thin cells which has good hole-proof vacancy nature to impacts, such as drop and a collision, the pressure in the sharp thing, etc. as the object, without thickening the metallic foil which constitutes a laminate material, or protecting it with a strong box.
[0007]
[Means for Solving the Problem] In order to attain the above-mentioned object, a bag body for thin cells of this invention is a bag body for containing a generation-of-electrical-energy element for thin cells, and takes a configuration that an elastic thin layer is formed in the condition of having stuck to a bag body, all over one [at least] field of a front face of a bag body, and a rear face.
[0008] Namely, since an elastic thin layer is formed where a bag body for thin cells of this invention is stuck to a bag body all over one [at least] field of the front face and a rear face, By this elastic thin layer, though the impact-absorption nature of a bag body for thin (elastic thin layer especially formed in the periphery section of field of method of up Norikazu) cells improves substantially and a flexible effect is held, impacts, such as drop and a collision, can be responded to and absorbed by the above-mentioned elastic thin layer. Therefore, in case it inserts in electronic equipment, even if it hits a projected part inside electronic equipment or there are drop of a thin cell under a manufacturing process and transport, a collision to other objects, a drop impact of the whole device electronic equipment in use, etc. Since there is no possibility of inviting **** of a laminate material, there is no danger, such as vaporization of the electrolytic solution and leakage, and that a hole opens to a laminate material etc. does not cause deterioration of cell engine performance by encroachment of moisture from the outside. And even if it is what sharpened (elastic thin layer especially formed in idiosoma of a field of a method of up Norikazu) and stabs with idiosoma of a laminate material by the above-mentioned elastic thin layer When what sharpened even if it penetrated is extracted, in order for what sharpened by the above-mentioned elastic thin layer to be unable to penetrate a laminate material easily, and for an elastic thin layer to revert and to plug up a hole, In this case, there is no danger, such as vaporization of the electrolytic

solution and leakage, and deterioration of cell engine performance is not caused by encroachment of moisture from the outside (when it is the sharp thing and stabs with idiosoma of a laminate material). Furthermore, when an elastic thin layer is formed in a front face (namely, outer layer) of a bag body for thin cells, fixed stability when containing a bag body for thin cells inside electronic equipment improves, it does not shake inside electronic equipment, and a generation-of-electrical-energy element in a bag body for thin cells etc. does not break over a long period of time.

[0009] In this invention, since it excels also in flexibility in a rubber layer or a thermoplastic-elastomer layer being excellent in impact-absorption nature when the above-mentioned elastic thin layer is a rubber layer or a thermoplastic-elastomer layer, it is the optimal as an elastic thin layer.

[0010] Also when joining a laminate material with which an elastic thin layer was formed in a front face when it consisted of a resin layer in which a inner layer of a bag body has heat-sealing nature in this invention and an elastic thin layer formed on the surface of a bag body consisted of an insulating layer which is not fused at the time of heat sealing with heat sealing and producing a bag body, good heat sealing can be performed.

[0011] Below, this invention is explained in detail.

[0012] As for a bag body for thin cells of this invention, an elastic thin layer is formed all over one [at least] field of the front face and a rear face.

[0013] The whole surface of a front face of a bag body for thin cells is sufficient as a portion in which the above-mentioned elastic thin layer is formed, the whole surface on the back is sufficient as it, and the whole surface of front reverse side both sides is sufficient as it.

[0014] Thickness of the above-mentioned elastic thin layer is set up within the limits of 0.03mm - 2mm, and is suitably set up within the limits of 0.08mm - 1mm. If the above-mentioned thickness is less than 0.03mm, an effect of an impact-absorption nature rise will no longer be acquired, and if it exceeds 2mm, an effect of lightweight nature and flexibility will no longer be acquired. Moreover, when the above-mentioned thickness is set as within the limits which is 0.08mm - 1mm, while a lower limit of the above-mentioned thickness will exceed 0.03mm and an effect of an impact-absorption nature rise improves, a upper limit of the above-mentioned thickness will be less than 2mm, and an effect of lightweight nature and flexibility improves. And even if heads, such as a needle, are acute and stab, it is hard coming to penetrate a laminate material.

[0015] A laminate material which constitutes the above-mentioned bag body for thin cells consists of a film base material usually equipped with a metal layer, an inside resin layer (it acts also as a sealant also as an insulating layer) formed in an inner surface of this metal layer, and an outside resin layer formed in an outside surface of the above-mentioned metal layer. Although aluminum, an aluminum alloy, copper, a copper alloy, iron, a stainless steel foil, titanium, a titanium alloy, etc. are used at a point excellent in gas cutoff of moisture, oxygen, etc. as a metallic material which constitutes the above-mentioned metal layer and it is fabricated by various gestalten, such as a foil, aluminium foil is desirable in respect of a light weight and low cost.

[0016] Moreover, as a resin material which constitutes the above-mentioned inside resin layer, although polypropylene (PP), polyethylene (PE), conversion polypropylene, polyester, a polyacrylonitrile, polyvinyl acetate, vinyl acetate, a polyamide, tetrafluoroethylene resin (PTFE), polyvinylidene fluoride resin (PVDF), etc. are used, barrier property and a chemical-resistant field to PP and PE are desirable, and conversion polypropylene is desirable from a field of seal nature. Moreover, as a resin material which constitutes the above-mentioned outside resin layer, although various kinds of materials are used, a resin material which constitutes the above-mentioned inside resin layer, and same material are usually used. Thickness of such a laminate material is set up within the limits of 12 micrometers - 150 micrometers.

[0017] As a spring material which constitutes the above-mentioned elastic thin layer, a rubber system material or a thermoplastic-elastomer system material is used. As the above-mentioned rubber system material, NBR, NR, EPDM, SBR, isobutylene isoprene rubber, silicone rubber, etc. are used, and the active substance, such as an urethane system, an epoxy system, a silicone system, and silane coupling material to rubber, is used as adhesives for rubber systems. On the other hand, as the above-mentioned thermoplastic-elastomer system material, an olefin system elastomer, a styrene system elastomer, etc. are used, and a conversion olefin system elastomer, a conversion styrene system elastomer, etc. are used as adhesives for thermoplastic-elastomer systems. When forming such an elastic thin layer on the surface of a laminate material (namely, outer layer), an outside resin layer can be omitted, and when forming in a rear face (namely, inner layer) of a laminate material, an inside resin layer can be omitted.

[0018] Such a bag body for thin cells can be fabricated to a wave, and flexibility can be raised. In this case, this may be processed into a wave after sticking an elastic thin layer to a front face of a laminate material, a rear face, or front reverse side both sides by pressure through adhesives after processing a laminate material into a wave, and forming an elastic thin layer in a front face, a rear face, or front reverse side both sides of a laminate material. For example, when preparing a rubber layer as an elastic thin layer, wave processing of the laminate material may be carried out at rubberizing Ushiro, after carrying out wave processing of the laminate material, rubberizing may be carried out, and after carrying out wave processing of the laminate material, rubber cement with which adhesives were mixed may be applied, heated and vulcanized [dry and].

[0019]

[Embodiment of the Invention] Below, the gestalt of operation of this invention is explained based on a drawing.

[0020] Drawing 1 is the fragmentary sectional view showing the gestalt of 1 operation of the bag body 1 for thin cells of this invention. With the gestalt of this operation, the generation-of-electrical-energy element of the lithium polymer rechargeable battery using the gel polymer electrolyte which consisted of a positive-electrode charge collector 21 of drawing 11 - a negative-electrode charge collector 25 is used as a generation-of-electrical-energy element for thin cells (not shown). The magnitude of this generation-of-electrical-energy element is usually a 40mmx80mmx2mm (thickness) degree. Moreover, the inside resin layer 3 with a thickness of 30 micrometers it is thin from conversion polypropylene (Mitsui Chemicals, Inc. make QF551) as a laminate material 2 which constitutes the bag body 1 for thin cells, The film base material which consists of a medium metal layer 4 with a thickness of 30 micrometers it is thin from aluminium foil, and an outside rubber layer (elastic thin layer) 6 with a thickness of 200 micrometers it is thin from the hydrogenation NBR pasted up and fixed by minding the urethane system adhesives layer 5 all over this medium metal layer 4 is used. It is fabricating to the rectangular bag-like object with the four-way-type seal method as this shown drawing 10 . That is, superposition and its opened neighborhood are heat sealed for the laminate material 2 of two sheets in the shape of a confrontation. The neighborhood is heat sealed and the electrode 27 of a generation-of-electrical-energy element is made to usually project outside from heat-sealing section of one side 26a in this shaping, where a generation-of-electrical-energy element is arranged between the laminate materials 2 of two sheets (refer to drawing 10).

[0021] As mentioned above, since the outside rubber layer 6 is formed all over the front face of the bag body 1 for thin cells with the gestalt of this operation, Though the flexibility of the bag body 1 for thin cells is held, the impact-absorption nature increases dramatically, where

a generation-of-electrical-energy element is contained inside the bag body 1 for thin cells, even if drop etc. carries out this, the impact is absorbed in the above-mentioned outside rubber layer 6, and the hole of open Lycium chinense is almost lost to the bag body 1 for thin cells. And even if a needle etc. cannot penetrate a laminate material 2 easily even if it stabs the idiosoma of a laminate material 2 etc. with a needle etc., and it penetrates a laminate material 2, when a needle etc. is extracted, the outside rubber layer 6 reverts immediately and plugs up a hole.

[0022] Drawing 2 is the fragmentary sectional view showing the gestalt of other operations of the bag body 1 for thin cells of this invention. He has given the shape of a wave with a pitch 1.8mm and a wave height of 0.4mm to the laminate material 2 shown in drawing 1 , and is trying for this to raise flexibility to it more with the gestalt of this operation. The other portion is the same as that of the gestalt of the above-mentioned implementation, and gives the same sign to the same portion. Also with the gestalt of this operation, the same operation and effect as the gestalt of the above-mentioned implementation are done so. And since the laminate material 2 is formed in the shape of a wave, there is flexibility and it excels in elasticity and flexibility.

[0023] Drawing 3 is the fragmentary sectional view of the bag body 1 for thin cells of this invention showing the gestalt of other operations further. With the gestalt of this operation, in the gestalt of operation shown in drawing 2 , it replaced with the inside resin layer 3 of a laminate material 2, and the inside rubber layer 8 with a thickness of 30 micrometers it is thin from an olefin system elastomer is formed through the adhesives layer 7 which becomes the inner surface of the medium metal layer 4 from a conversion olefin system elastomer. The other portion is the same as that of the gestalt of operation shown in drawing 2 , and gives the same sign to the same portion. Also with the gestalt of this operation, the same operation and effect as the gestalt of operation shown in drawing 2 are done so. And with the gestalt of this operation, since the inside rubber layer 8 is formed also in the rear face of the bag body 1 for thin cells, a hole-proof vacancy trial improves compared with the gestalt of operation shown in drawing 2 . Moreover, heat-sealing nature is conventionally equivalent as compared with elegance, and the good heat-sealing force was acquired by 160 degree-Cx10sec.

[0024]

[The example article 1 and 2 and the example article 1 and 2 of a comparison] As an example article 1, the bag body 1 for thin cells of the structure shown in drawing 2 was prepared, and the bag body 1 for thin cells of the structure shown in drawing 1 was prepared as an example article 2. Moreover, an inside resin layer (Mitsui Chemicals, Inc. make QF551) with a thickness of 30 micrometers is prepared in the inner surface of a medium metal layer (aluminium foil) with a thickness of 30 micrometers through an urethane system adhesives layer as an example article 1 of a comparison. The bag body for thin cells (not shown) which consists of a laminate material which prepared the outside resin layer (PP) with a thickness of 30 micrometers in the outside surface of a medium metal layer through the urethane system adhesives layer (it is not fabricating in the shape of a wave) was prepared. Moreover, in the bag body 1 for thin cells of the structure shown in drawing 1 , the bag body for thin cells (not shown) which prepared the outside rubber layer was prepared only for the portion except the periphery section as an example article 2 of a comparison (neighborhood). And hole-proof vacancy nature (drop-proof hole vacancy nature, idiosoma-proof ****, needling-proof nature) and flexibility were investigated using these examples article 1 and 2 and the example article 1 and 2 of a comparison.

[0025] About the above-mentioned drop-proof hole vacancy nature (even if it falls, a hole is a pile to an aperture in the angle of a laminate material 2 by the impact-absorption nature of the outside rubber layer 6), the count of drop until a hole opens to a laminate material 2 was investigated. That is, as shown in drawing 4 , the bag body 1 for thin cells which contained the generation-of-electrical-energy element is dropped from the height of 80cm of upper parts of an aluminum plate 11 (thickness of 2cm). In the case of this drop, he drops the inside of a barrel 12 perpendicularly, and is trying for the corner of the bag body 1 for thin cells to hit on an aluminum plate 11 (experiment 1).

[0026] About the above-mentioned idiosoma-proof **** (even if an acute angle object hits, a hole is a pile to an aperture in the idiosoma of a laminate material 2 by the impact-absorption nature of the outside rubber layer 6) As shown in drawing 5 , the bag body 1 for thin cells which contained the generation-of-electrical-energy element is laid on an aluminum plate 13. Lay the cylinder object 14 in the center of the idiosoma of the bag body 1 for thin cells, and the above-mentioned head of the head R(R)1cm triangular pyramid 15 is made to touch the idiosoma of the bag body 1 for thin cells at 90 degrees whenever [point-angle]. A triangular pyramid 15 is installed in the above-mentioned cylinder object 14, and weight 16 is dropped on a triangular pyramid 15 from the height of 80cm of upper parts of this triangular pyramid 15 (experiment 2).

[0027] The laminate material 2 of the bag body 1 for thin cells is stabbed with a needle 17, and is made to penetrate about the above-mentioned needling-proof nature (for the outside rubber layer 6 to revert, for a hole to be plugged up, when a needle is extracted, and for encroachment of leakage of the electrolytic solution etc., the open air, and moisture to be prevented, even if it stabs the idiosoma of a laminate material 2 with a needle and makes it penetrate) (refer to drawing 6 .). The thing which made the needle 17 penetrate is shown in the example article 2 at drawing 6 . The equipment shown in drawing 7 investigates loss in quantity (mg/day) of the water in the container 18 of 24 hours after after it using this test piece (experiment 3).

[0028] About the above-mentioned flexibility, the radius of curvature of a bend in case a crease goes both the sides of each bag body 1 for thin cells into bending and each bag body 1 for thin cells is measured. Consequently, in the example article 1, when both sides were bent about 5mm in the example article 2 to a crease having not arisen in the radius of curvature of 10mm, the crease entered and the crack arose in the medium metal layer. Moreover, in the example article 1 of a comparison, when both sides were bent about 3mm, the crease entered and the crack arose in the medium metal layer. Moreover, in the example article 2 of a comparison, when both sides were bent about 5mm, the crease entered and the crack arose in the medium metal layer. The experimental result of such hole-proof vacancy nature and flexibility is shown in the following table 1.

[0029]

[A table 1]

		実施例品１	実施例品２	比較例品１	比較例品２
耐穴あき性	実験１	１０回	１０回	２回	１回
	実験２	１０回	１０回	３回	１０回
	実験３	０．３	０．３	５９	０．３
柔軟性		曲率半径１０mmでも折れじわ発生せず	５mmで折れじわ発生	３mmで折れじわ発生	５mmで折れじわ発生

[0030] It turns out that the example article 1 and 2 is excellent in hole-proof vacancy nature and flexibility compared with the example article 1 and 2 of a comparison so that clearly from the above-mentioned table 1. The example article 1 is also known by excelling dramatically especially about flexibility.
[0031] In addition, although what is shown in the configuration of the positive-electrode charge collector 21 of drawing 11 - the negative-electrode charge collector 25 as a generation-of-electrical-energy element for thin cells is used with the gestalt of operation shown in drawing 1 , it cannot limit to this and various kinds of generation-of-electrical-energy elements can be used.
[0032] Moreover, with the gestalt of operation shown in drawing 1 , although the outside rubber layer 6 is formed in the front face of a laminate material 2, a rubber layer may be prepared in the rear face of a laminate material 2. In this case, a rubber layer can be prepared in the inner surface of the inside resin layer 3, or it can replace with the inside resin layer 3, and a rubber layer can be prepared. Moreover, with the gestalt of operation shown in drawing 1 and drawing 3 , although the outside rubber layer 6 is formed in the front face of the medium metal layer 4, the outside rubber layer 6 can also be formed through a resin layer. Moreover, with the gestalt of operation shown in drawing 3 , although the inside rubber layer 8 is formed in the rear face of the medium metal layer 4, the inside rubber layer 8 can also be formed through the inside resin layer 3.
[0033] moreover, in fabricating the bag body 1 for thin cells Three-way-type seal (bend the laminate material 2 of one sheet in the center, and it is piled up) The pin center,large seal method of the pyro mold with which heat sealing etc. carries out the three opened sides (the laminate material of one sheet) After it makes it a cylinder object where the rear faces of the both ends are piled up, and heat sealing etc. carries out the portion doubled in the above-mentioned pile, The envelope method of the pyro mold with which heat sealing etc. carries out ends opening of a cylinder object (differing from the pin center,large seal method of a pyro mold) Although it is adopted that it is a point using the resin with which a table rear face has heat-sealing nature etc. in order to lay the rear face of one edge on top of the front face of the other-end section, when using the laminate material 2 of one sheet as a cylinder object In each [these] seal method, the rubber layer 6 and the elastic thin layer of 8 grades can be formed.
[0034]
[Effect of the Invention] As mentioned above, since the elastic thin layer is formed in the condition of having stuck to the bag body, all over one [at least] field of the front face and a rear face according to the bag body for thin cells of this invention, By this elastic thin layer, though the impact-absorption nature of the bag body for thin (elastic thin layer especially formed in the periphery section of field of method of up Norikazu) cells improves substantially and a flexible effect is held, impacts, such as drop and a collision, can be responded to and absorbed by the above-mentioned elastic thin layer. Therefore, in case it inserts in electronic equipment, even if it hits the projected part inside electronic equipment or there are drop of the thin cell under a manufacturing process and transport, a collision to other objects, a drop impact of the whole device electronic equipment in use, etc. Since there is no possibility of inviting **** of a laminate material, there is no danger, such as vaporization of the electrolytic solution and leakage, and that a hole opens to a laminate material etc. does not cause deterioration of the cell engine performance by encroachment of the moisture from the outside. And even if it is what sharpened (elastic thin layer especially formed in the idiosoma of the field of the method of up Norikazu) and stabs with the idiosoma of a laminate material by the above-mentioned elastic thin layer When what sharpened even if it penetrated is extracted, in order for what sharpened by the above-mentioned elastic thin layer to be unable to penetrate a laminate material easily, and for an elastic thin layer to revert and to plug up a hole, In this case, there is no danger, such as vaporization of the electrolytic solution and leakage, and deterioration of the cell engine performance is not caused by encroachment of the moisture from the outside (when it is the sharp thing and stabs with the idiosoma of a laminate material). Furthermore, when the elastic thin layer is formed in the front face (namely, outer layer) of the bag body for thin cells, the fixed stability when containing the bag body for thin cells inside electronic equipment improves, it does not shake inside electronic equipment, and the generation-of-electrical-energy element in the bag body for thin cells etc. does not break over a long period of time.
[0035] Moreover, in this invention, since it excels also in flexibility in a rubber layer or a thermoplastic-elastomer layer being excellent in impact-absorption nature when the above-mentioned elastic thin layer is a rubber layer or a thermoplastic-elastomer layer, it is the optimal as an elastic thin layer.
[0036] Also when joining the laminate material with which the elastic thin layer was formed in the front face when it consisted of a resin layer in which the inner layer of a bag body has heat-sealing nature in this invention and the elastic thin layer formed on the surface of the bag body consisted of an insulating layer which is not fused at the time of heat sealing with heat sealing and producing a bag body, good heat sealing can be performed.

[Translation done.]